87

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/763,772	02/26/2001	Gustavo Deco	P00,1993	6347

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EXAMINER	
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ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/763,772	DECO ET AL.	
	Examiner	Art Unit	
	Meltin Bell	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 September 2004* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☒ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

This non-final action is responsive to application **09/763,772** filed 02/26/2001 (national stage entry of PCT/DE99/01949 International Filing Date: 07/01/1999) as well as the Amendment filed 4/25/05. Claims 1-16 filed by the applicant have been entered and examined. An action on the merits of claims 1-16 appears below.

Priority

Acknowledgment is made of applicant's claim for foreign priority based on application number 198 38 654.0 filed in Germany on **8/25/98**.

Claim Rejections - 35 USC § 103

Applicant's arguments have been fully considered, but are moot in view of new grounds of rejection. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the Office presumes that the subject matter of the

various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the Office to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 8, 11 and 14 are rejected under 35 U.S.C. 103(a) as being obvious over *Jourjine* United States Patent Number (USPN) 4,953,099 "Information Discrimination Cell" (Aug. 28, 1990) in view of *Clymer* USPN 4,518,866 "Method of and circuit for simulating neurons" (May 21, 1985) and in further view of *Ueda et al* USPN 5,119,438 "Recognizing apparatus" (Jun. 2, 1992).

Regarding claim 1:

Jourjine teaches a method (Abstract) for training a neural network that contains pulsed neurons, comprising: forming discrimination values dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); training the neural network for a first time span (Fig. 4; column 5, lines 31-59) such that a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: shortening the first time span to a second time span (column 2, lines 37-55; column 5, lines 2-5); forming a second discrimination value for the second time span. However, *Jourjine* doesn't explicitly teach shortening the

second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value and choosing as the trained neural network the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value while *Clymer* teaches shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); forming a second discrimination value for the shortened second time span; iteratively (column 3, lines 48-68; column 4, lines 1-11) continuing to shorten the second time span and form a second discrimination value for each shortened second time span until the second discrimination value is different from the first discrimination value (Abstract) and *Ueda et al* teaches choosing as the trained neural network (column 2, lines 25-52) the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value.

Motivation – The portions of the claimed method would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer* and *Ueda et al* for the purpose of

simulating the neuron's function of learning and setting the structure and weights of a neural network selected by the network selecting means.

Regarding claim 8:

Jourjine teaches a method (Abstract) for classification of a sequence of input quantities upon employment of a neural network that contains pulsed neurons and was trained, comprising to the following steps: forming discrimination values dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); training the neural network for a first time span (Fig. 4; column 5, lines 31-59) such that a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: shortening the first time span to a second time span (column 2, lines 37-55; column 5, lines 2-5); forming a second discrimination value for the second time span. However, *Jourjine* doesn't explicitly teach shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value and choosing as the trained neural network the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value while *Clymer* teaches shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); forming a second discrimination value for the shortened second time span; iteratively (column 3, lines 48-68; column 4, lines 1-11) continuing to shorten the second

time span and form a second discrimination value for each shortened second time span until the second discrimination value is different from the first discrimination value (Abstract) and *Ueda et al* teaches choosing as the trained neural network (column 2, lines 25-52) the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value; supplying the sequence of input quantities to the neural network; forming a classification signal that indicates what kind of sequence of input quantities the supplied sequence is (Fig 1, items 1-3; Fig. 2, items S1-S2; Fig. 4).

Motivation – The portions of the claimed method would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer* and *Ueda et al* for the purpose of simulating the neuron's function of learning and setting the structure and weights of a neural network selected by the network selecting means.

Regarding claim 11:

Jourjine teaches a neural network that contains pulsed neurons and has been trained according to the following steps: discrimination values are formed dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input

quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); the neural network is trained such that for a first time span (Fig. 4; column 5, lines 31-59) a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: the first time span is shortened to a second time span (column 2, lines 37-55; column 5, lines 2-5); a second discrimination value is formed for the second time span. However, *Jourjine* doesn't explicitly teach the second time span is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value and the trained neural network is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value while *Clymer* teaches the second time span is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); a second discrimination value is formed for the shortened second time span; the second time span is shortened and a second discrimination value is formed for each shortened second time span, iteratively (column 3, lines 48-68; column 4, lines 1-11), until the second discrimination value is different from the first discrimination value (Abstract) and *Ueda et al* teaches the trained neural network (column 2, lines 25-52) is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value.

Motivation – The portions of the claimed neural network would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a

biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer* and *Ueda et al* for the purpose of simulating the neuron's function of learning and setting the structure and weights of a neural network selected by the network selecting means.

Regarding claim 14:

Jourjine teaches a system for training a neural network (column 1, lines 13-25) that contains pulsed neurons, comprising: a processor that is configured such that the following steps implemented: the neural network is trained such that for a first time span of data input (Fig. 4; column 5, lines 31-59) a discrimination value is maximized, as a result whereof a maximum first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: the first time span of data input is shortened to a second time span of data input (column 2, lines 37-55; column 5, lines 2-5). However, *Jourjine* doesn't explicitly teach the second time span of data input is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value and the trained neural network is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value while *Clymer* teaches the second time span of data input is shortened to a shortened second time span of

data input if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); a second discrimination value is formed for the shortened second time span of data input; the second time span of data input is shortened and a second discrimination value is formed for each shortened second time span of data input, iteratively (column 3, lines 48-68; column 4, lines 1-11), until the second discrimination value is different from the first discrimination value (Abstract) and *Ueda et al* teaches the trained neural network (column 2, lines 25-52) is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value.

<u>Motivation</u> – The portions of the claimed system would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer* and *Ueda et al* for the purpose of simulating the neuron's function of learning and setting the structure and weights of a neural network selected by the network selecting means.

Claims 2-3 are rejected under 35 U.S.C. 103(a) as being obvious over *Jourjine* in view of *Clymer* in view of *Ueda et al* and further in view of *Peng et al* "Generalization

and Comparison of Alopex Learning Algorithm and Random Optimization Method for Neural Networks" (May 1998).

Regarding claim 2:

Jourjine teaches a method (Abstract) for training a neural network that contains pulsed neurons, comprising: forming discrimination values dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); training the neural network for a first time span (Fig. 4; column 5, lines 31-59) such that a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: shortening the first time span to a second time span (column 2, lines 37-55; column 5, lines 2-5); forming a second discrimination value for the second time span. However, *Jourjine* doesn't explicitly teach shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value, choosing as the trained neural network the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value and an optimization method that is not gradient based is utilized for the maximization of at least one of the first discrimination value and of the second discrimination value while *Clymer* teaches shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); forming a second discrimination value for the shortened second time span; iteratively (column 3, lines 48-68; column 4, lines 1-11)

continuing to shorten the second time span and form a second discrimination value for each shortened second time span until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches choosing as the trained neural network (column 2, lines 25-52) the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value and *Peng et al* teaches an optimization method that is not gradient based is utilized for the maximization of at least one of the first discrimination value and of the second discrimination value (page 1147, Abstract).

Motivation – The portions of the claimed method would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and converging faster (*Peng et al*, page 1148, section V, paragraph 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer, Ueda et al* and *Peng et al* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and converging faster.

Regarding claim 3:

The rejection of claim 3 is the same as that for claim 2 as recited above since the stated limitations of the claim are set forth in the references.

Claims 4-5 are rejected under 35 U.S.C. 103(a) as being obvious over *Jourjine* in view of *Clymer* in view of *Ueda et al* and further in view of *Deco et al* "Information Transmission and Temporal Code in Central Spiking Neurons" (December 8, 1997).

Regarding claims 4:

Jourjine teaches a method (Abstract) for training a neural network that contains pulsed neurons, comprising: forming discrimination values dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); training the neural network for a first time span (Fig. 4; column 5, lines 31-59) such that a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: shortening the first time span to a second time span (column 2, lines 37-55; column 5, lines 2-5); forming a second discrimination value for the second time span. However, *Jourjine* doesn't explicitly teach shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value, choosing as the trained neural network the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value and the first discrimination value I(T) satisfies the following rule:

$$I(T) = I\left(s; \left\{ \begin{array}{c} t_1^{(1)},\ldots,t_m^{(1)},\ldots,t_{k1}^{(1)},t_1^{(2)},\ldots,t_m^{(2)},\ldots,t_{k2}^{(2)},\ldots, \\ \end{array} \right\} \right),$$

$$t_1^{(n)},\ldots,t_m^{(n)},\ldots,t_{kn}^{(n)},\ldots,t_1^{(N)},\ldots,t_m^{(N)},\ldots,t_{kN}^{(N)}$$

wherein

- s references input quantities,
- $t_m^{(n)}$ references a pulse that is generated by a pulsed neuron n at a time m within a time span [0, T],
- k_n (n=1,...,N) references a point in time at which the pulsed neuron n has generated the last pulse within the time span [0,T], and

N references a plurality of pulsed neurons contained in the neural network while *Clymer* teaches shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); forming a second discrimination value for the shortened second time span; iteratively (column 3, lines 48-68; column 4, lines 1-11) continuing to shorten the second time span and form a second discrimination value for each shortened second time span until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches choosing as the trained neural network (column 2, lines 25-52) the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value and *Deco et al* teaches the first discrimination value I(T) satisfies the following rule:

$$I(T) = I\left(s; \left\{\begin{array}{c} t_1^{(1)},\ldots,t_m^{(1)},\ldots,t_{k1}^{(1)},t_1^{(2)},\ldots,t_m^{(2)},\ldots,t_{k2}^{(2)},\ldots, \\ t_1^{(n)},\ldots,t_m^{(n)},\ldots,t_{kn}^{(n)},\ldots,t_1^{(N)},\ldots,t_m^{(N)},\ldots,t_{kN}^{(N)} \end{array}\right\}\right),$$

wherein

- s references input quantities,

- $t_m^{(n)}$ references a pulse that is generated by a pulsed neuron n at a time m within a time span [0, T],
- k_n (n=1,...,N) references a point in time at which the pulsed neuron n has generated the last pulse within the time span [0,T], and
- N references a plurality of pulsed neurons contained in the neural network

(page 4697, paragraph 2) and decision time as related to discriminability (page 4699, paragraph 2).

<u>Motivation</u> – The portions of the claimed method would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and efficiently discriminating input signals (*Deco et al*, page 4700, paragraph 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer, Ueda et al* and *Deco et al* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and efficiently discriminating input signals.

Regarding claim 5:

The rejection of claim 5 is similar to that for claim 4 as recited above since the stated limitations of the claim are set forth in the references. Claim 5's limitations difference is taught in *Deco et al*:

- the first discrimination value I(T) satisfies the following rule:

$$I(T) = - \mathrm{I}\ p(out) \cdot \ln(p(out))dt_1^{(1)} \ldots dtk_1^{(1)} \ldots dt_{kN}^{(N)} +$$

$$+ \overset{s}{\underset{j=1}{3}} p_j\ \mathrm{I}\ p(out|s^{(j)}) \cdot \ln(p(out|s^{(j)}))dt_1^{(1)} \ldots dtk_1^{(1)} \ldots dt_{kN}^{(N)}$$

with

$$p(out) = \overset{s}{\underset{j=1}{3}} p_j p(out|s^{(j)}),$$

wherein

- $s^{(j)}$ references an input quantity that is applied to the neural network at a time j,
- p_j references a probability that the input quantity $s^{(j)}$ is applied to the neural network at a pint in time j,
- $p(out|s^{(j)})$ references a conditioned probability that a pulse is generated by a pulsed neuron in the neural network under the condition that the input quantity $s^{(j)}$ is applied to the neural network at a point in time j

(page 4697, paragraph 3, "In the second...in the interval [*t'*, *t'* + *T*]"; page 4698, paragraph 1, "where *t'* is...same rate *R*")

Claims 6-7, 9-10, 12-13 and 15-16 are rejected under 35 U.S.C. 103(a) as being obvious over *Jourjine* in view of *Clymer* in view of *Ueda et al* and further in view of

Belmonte "Prediction of attention in autism from single-trial EEG using artificial neural networks" (August 1997).

Regarding claim 6:

Jourjine teaches a method (Abstract) for training a neural network that contains pulsed neurons, comprising: forming discrimination values dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); training the neural network for a first time span (Fig. 4; column 5, lines 31-59) such that a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: shortening the first time span to a second time span (column 2, lines 37-55; column 5, lines 2-5); forming a second discrimination value for the second time span. However, *Jourjine* doesn't explicitly teach shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value, choosing as the trained neural network the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value and the training sequence of inputs quantities are is of measured physical signals while *Clymer* teaches shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); forming a second discrimination value for the shortened second time span; iteratively (column 3, lines 48-68; column 4, lines 1-11) continuing to shorten the second time span and form a second discrimination value for

each shortened second time span until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches choosing as the trained neural network (column 2, lines 25-52) the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value and *Belmonte* teaches the training sequence of inputs quantities are is of measured physical signals (page 1, Introduction).

Motivation – The portions of the claimed method would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and seeing some success in the application of ANNs to single-trial EEG analysis (*Belmonte*, page 3, right column, last paragraph). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer, Ueda et al* and *Belmonte* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and seeing some success in the application of ANNs to single-trial EEG analysis.

Regarding claim 7:

The rejection of claim 7 is the same as that for claim 6 as recited above since the stated limitations of the claim are set forth in the references.

Regarding claim 9:

Jourjine teaches a method (Abstract) for classification of a sequence of input quantities upon employment of a neural network that contains pulsed neurons and was trained, comprising to the following steps: forming discrimination values dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); training the neural network for a first time span (Fig. 4; column 5, lines 31-59) such that a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: shortening the first time span to a second time span (column 2, lines 37-55; column 5, lines 2-5); forming a second discrimination value for the second time span. However, *Jourjine* doesn't explicitly teach shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value, choosing as the trained neural network the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value and the training sequence of input quantities and the sequence of input quantities are measured physical signals while *Clymer* teaches shortening the second time span to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); forming a second discrimination value for the shortened second time span; iteratively (column 3, lines 48-68; column 4, lines 1-11) continuing to shorten the second time span and form a second discrimination value for

each shortened second time span until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches choosing as the trained neural network (column 2, lines 25-52) the neural network of the last iteration wherein the second discrimination value is the same as the first discrimination value; supplying the sequence of input quantities to the neural network; forming a classification signal that indicates what kind of sequence of input quantities the supplied sequence is (Fig 1, items 1-3; Fig. 2, items S1-S2; Fig. 4) and *Belmonte* teaches the training sequence of input quantities and the sequence of input quantities are measured physical signals (page 1, Introduction).

Motivation – The portions of the claimed method would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and seeing some success in the application of ANNs to single-trial EEG analysis (*Belmonte*, page 3, right column, last paragraph). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer, Ueda et al* and *Belmonte* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and seeing some success in the application of ANNs to single-trial EEG analysis.

Regarding claims 10:

The rejection of claim 10 is the same as that for claim 9 as recited above since the stated limitations of the claim are set forth in the references.

Regarding claim 12:

Jourjine teaches a neural network that contains pulsed neurons and has been trained according to the following steps: discrimination values are formed dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); the neural network is trained such that for a first time span (Fig. 4; column 5, lines 31-59) a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: the first time span is shortened to a second time span (column 2, lines 37-55; column 5, lines 2-5); a second discrimination value is formed for the second time span. However, *Jourjine* doesn't explicitly teach the second time span is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value, the trained neural network is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and the network is utilized for the classification of a physical signal while *Clymer* teaches the second time span is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); a second discrimination value is formed for the shortened second time span; the second time span is shortened and a second

discrimination value is formed for each shortened second time span, iteratively (column 3, lines 48-68; column 4, lines 1-11), until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches the trained neural network (column 2, lines 25-52) is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and *Belmonte* teaches the network is utilized for the classification of a physical signal (page 1, Introduction).

Motivation – The portions of the claimed neural network would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and seeing some success in the application of ANNs to single-trial EEG analysis (*Belmonte*, page 3, right column, last paragraph). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer* and *Ueda et al* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and seeing some success in the application of ANNs to single-trial EEG analysis.

Regarding claim 13:

Jourjine teaches a neural network that contains pulsed neurons and has been trained according to the following steps: discrimination values are formed dependent on pulses that are formed by the pulsed neurons as well as on a training sequence of input quantities (Figs. 4-6; column 5, lines 58-68; column 6, lines 1-44) that are supplied to the neural network (Fig. 1); the neural network is trained such that for a first time span (Fig. 4; column 5, lines 31-59) a discrimination value is maximized, as a result whereof a first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: the first time span is shortened to a second time span (column 2, lines 37-55; column 5, lines 2-5); a second discrimination value is formed for the second time span. However, *Jourjine* doesn't explicitly teach the second time span is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value, the trained neural network is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and utilized for the classification of an electroencephalogram signal while *Clymer* teaches the second time span is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); a second discrimination value is formed for the shortened second time span; the second time span is shortened and a second discrimination value is formed for each shortened second time span, iteratively (column 3, lines 48-68; column 4, lines 1-11), until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches the trained

neural network (column 2, lines 25-52) is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and *Belmonte* teaches utilized for the classification of an electroencephalogram signal (page 1, Introduction).

Motivation – The portions of the claimed neural network would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and seeing some success in the application of ANNs to single-trial EEG analysis (*Belmonte*, page 3, right column, last paragraph). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer* and *Ueda et al* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and seeing some success in the application of ANNs to single-trial EEG analysis.

Regarding claim 15:

Jourjine teaches a system for training a neural network (column 1, lines 13-25) that contains pulsed neurons, comprising: a processor that is configured such that the following steps implemented: the neural network is trained such that for a first time span of data input (Fig. 4; column 5, lines 31-59) a discrimination value is maximized, as a

result whereof a maximum first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: the first time span of data input is shortened to a second time span of data input (column 2, lines 37-55; column 5, lines 2-5). However, *Jourjine* doesn't explicitly teach the second time span of data input is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value, the trained neural network is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and the network is utilized for the classification of a physical signal while *Clymer* teaches the second time span of data input is shortened to a shortened second time span of data input if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); a second discrimination value is formed for the shortened second time span of data input; the second time span of data input is shortened and a second discrimination value is formed for each shortened second time span of data input, iteratively (column 3, lines 48-68; column 4, lines 1-11), until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches the trained neural network (column 2, lines 25-52) is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and *Belmonte* teaches the network is utilized for the classification of a physical signal (page 1, Introduction).

Motivation – The portions of the claimed system would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a

biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and seeing some success in the application of ANNs to single-trial EEG analysis (*Belmonte*, page 3, right column, last paragraph). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer, Ueda et al* and *Belmonte* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and seeing some success in the application of ANNs to single-trial EEG analysis.

Regarding claim 16:

Jourjine teaches a system for training a neural network (column 1, lines 13-25) that contains pulsed neurons, comprising: a processor that is configured such that the following steps implemented: the neural network is trained such that for a first time span of data input (Fig. 4; column 5, lines 31-59) a discrimination value is maximized, as a result whereof a maximum first discrimination value is formed (Fig. 3; column 4, lines 60-68; column 5, lines 1-2); after the first discrimination value is formed: the first time span of data input is shortened to a second time span of data input (column 2, lines 37-55; column 5, lines 2-5). However, *Jourjine* doesn't explicitly teach the second time span of data input is shortened to a shortened second time span if the second discrimination value is the same as the first discrimination value, the trained neural

network is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and the network is utilized for the classification of a signal of an electroencephalogram while *Clymer* teaches the second time span of data input is shortened to a shortened second time span of data input if the second discrimination value is the same as the first discrimination value (column 11, lines 19-36); a second discrimination value is formed for the shortened second time span of data input; the second time span of data input is shortened and a second discrimination value is formed for each shortened second time span of data input, iteratively (column 3, lines 48-68; column 4, lines 1-11), until the second discrimination value is different from the first discrimination value (Abstract), *Ueda et al* teaches the trained neural network (column 2, lines 25-52) is chosen to be the neural network of the last iteration when the second discrimination value was the same as the first discrimination value and *Belmonte* teaches the network is utilized for the classification of a signal of an electroencephalogram (page 1, Introduction).

Motivation – The portions of the claimed system would have been a highly desirable feature in this art for simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24) and seeing some success in the application of ANNs to single-trial EEG analysis (*Belmonte*, page 3, right column, last paragraph). Therefore, it would have been obvious to one of

ordinary skill in the art at the time the invention was made, to modify *Jourjine* as taught by *Clymer, Ueda et al* and *Belmonte* for the purpose of simulating the neuron's function of learning, setting the structure and weights of a neural network selected by the network selecting means and seeing some success in the application of ANNs to single-trial EEG analysis.

RESPONSE TO APPLICANTS' AMENDMENT REMARKS

Claim Rejections - 35 USC § 103

Applicant argues that it would not have been obvious to one having ordinary skill in the art to modify *Buckley* USPN 5,940,529 as taught by *Gevins* USPN 5,119,816 and *Arroyo et al* "A Modular Software Real-Time Brain Wave Detection System" because they belong to different fields of scientific research (Amendment REMARKS page 7, paragraph 5). Applicant's arguments have been fully considered, but are moot in view of new grounds of rejection. The examiner agrees that *Jourjine* USPN 4,953,099, *Clymer* USPN 4,518,866 and *Ueda et al* USPN 5,119,438 belong to the same field of scientific research as supported by their United States Classifications: 706/41 Artificial Intelligence Neural Network Structure Digital neural network and 382/158 Image Analysis Learning Systems Neural networks Network structures, for examples. Furthermore, the purpose and motivation for modifying *Jourjine* as taught by the other references include simulating both the known and theoretical functioning of a biological neuron and more importantly, for simulating the neuron's function of learning (*Clymer*, column 1, lines 6-12) as well as setting the structure and weights of a neural network

selected by the network selecting means and a discriminating algorithm appropriate to the selected category (*Ueda et al*, column 2, lines 16-24).

Applicant argues that *Buckley* column 13, lines 43-46 in combination with *Gevins*, *Arroyo et al, Cooley et al* "Combining structural and spectral information for discrimination using pulse coupled neural networks in multispectral and hyperspectral data", *Peng et al* "Generalization and Comparison of Alopex Learning Algorithm and Random Optimization Method for Neural Networks" and *Deco et al* "Information Transmission and Temporal Code in Central Spiking Neurons" is/are deficient regarding pulsed neural networks claim limitations (Amendment REMARKS page 7, paragraph 6-7 and page 8, paragraph 1) and that essential characteristics of pulsed neural networks cannot be found in *Buckley* or *Gevins* (Amendment REMARKS page 8, paragraph 3). Applicant's arguments have been fully considered, but are moot in view of the above new grounds of rejection. Though the examiner also agrees *Buckley, Gevins*, *Arroyo et al, Cooley et al*, *Peng et al* and *Deco et al* are deficient, *Jourjine* Fig. 1, *Clymer* column 11, lines 19-36 and *Ueda et al* column 2, lines 25-52 are examples of citations for explicitly and inherently meeting the pulsed neural networks/neuron claim limitations.

Applicant argues that *Gevins* does not mention anything about shortening a time span or pulse widths being shortened until a new discrimination value disagrees with an old discrimination value, that *Gevins* pulse widths are not equivalent to the claimed time span (Amendment REMARKS page 8, paragraph 4) and that none of the other references relied upon compensate for the deficiencies discussed above with regard to *Buckley* and *Gevins* (Amendment REMARKS page 8, paragraph 4). Applicant's

arguments have been fully considered, but are moot in view of the above new grounds of rejection. The examiner agrees *Jourjine* column 2, lines 37-55, column 5, lines 2-5, Figs. 4-6, column 5, lines 58-68 and column 6, lines 1-44 and *Clymer* column 11, lines 19-36, column 3, lines 48-68, column 4, lines 1-11 and Abstract, for examples, explicitly and inherently teach the time span, pulse width and discrimination value limitations of the claims.

As set forth with regards to *Jourjine*, *Clymer, Ueda et al, Peng et al, Deco et al* and *Belmonte*, the items listed explicitly and inherently teach each element of the applicants' claimed limitations. Applicants have not set forth any distinction or offered any dispute between the claims of the subject application, *Jourjine*'s Information Discrimination Cell, *Clymer's* Method of and circuit for simulating neurons, *Ueda et al*'s Recognizing apparatus, *Peng et al*'s Generalization and Comparison of Alopex Learning Algorithm and Random Optimization Method for Neural Networks, *Deco et al*'s Information Transmission and Temporal Code in Central Spiking Neurons and Belmonte's Prediction of attention in autism from single-trial EEG using artificial neural networks.

Specification Objections

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is required in correcting any errors of which applicant may become aware in the specification.

The disclosure is objected to because of the following informalities:

- 'interactively' on page 10, line 26, page 11, line 16 and page 12, lines 7 and 26 would read well as 'iteratively'
- 'wherein the second discrimination value is' on page 11, lines 5 and 23, page 12, line 14 and page 13, line 5 would read well as 'when the second discrimination value was'
- 'wherein' on page 21, line 19 would read well as 'when'
- 'of' on page 22, line 7 would read well removed

Appropriate correction is required.

Claim Objections

Claims 1, 6-8 and 13-14 are objected to because of the following informalities:

Regarding claim 1:

- 'wherein the second discrimination value is' on page 2 would read well as 'when the second discrimination value was'

Regarding claim 6:

- 'inputs quantities are is of' on page 3 would read well as 'input quantities are'

Regarding claim 7:

- 'input quantities is' on page 3 would read well as 'input quantities are'

Regarding claim 8:

- 'comprising to' on page 4 would read well as 'comprising'

- 'wherein the second discrimination value is' on page 4 would read well as 'when the second discrimination value was'

Regarding claim 13:

- '11, utilized' on page 5 would read well as '11, wherein the network is utilized'

Regarding claim 14:

- 'steps implemented' would read well as 'steps are implemented'

Appropriate correction is required.

Conclusion

The following prior art made of record is considered pertinent to applicant's disclosure:

- *Takenaga et al*; US 5086479 A; Information processing system using neural network learning function

- *Furuta et al*; US 5259064 A; Signal processing apparatus having at least one neural network having pulse density signals as inputs and outputs

- *Iwamoto et al*; US 5287430 A; Signal discrimination device using neural network

- *Deseino*; US 5371809 A; Neural network for improved classification of patterns which adds a best performing trial branch node to the network

- *Makram-Ebed*; US 5469530 A; Unsupervised training method for a neural net and a neural net classifier device

- *Parlos et al*; US 5479571 A; Neural node network and model, and method of teaching same

- *Rubenstein et al*; US 5485546 A; Discrimination and testing methods and apparatus employing adaptively changing network behavior based on spatial and heterocellular modification rules
- *Nunnally*; US 5615305 A; Neural processor element
- *Johnson*; US 5664065 A; Pulse-coupled automatic object recognition system dedicatory clause
- *Stork et al*; US 5963930 A; Apparatus and method for enhancing transfer function non-linearities in pulse frequency encoded neurons
- *Corchs et al*; US 20050119558 A1; Evaluation of images of the brain obtained by means of functional magnetic resonance tomography
- *Deco et al*; US 20050105463 A1; Method for classifying the traffic dynamism of a network communication using a network that contains pulsed neurons, neuronal network and system for carrying out said method
- *Deco et al*; US 20050009003 A1; Method and arrangement and computer programme with programme code means for the analysis of neuronal activities in neuronal areas
- *Schurmann et al*; US 20040234508 A1; Arrangement with artificial neurons for describing the transmission behavior of a nerve cell to be excited and method for determining the transmission behavior of a nerve cell to be excited using artificial neurons
- *Deco*; US 20030228054 A1; Neurodynamic model of the processing of visual information

- *Deco et al*; US 20030133611 A1; Method and device for determining an object in an image
- *Deco et al*; US 6363333 B1; Method of classifying statistical dependency of a measurable series of statistical values
- *Deco et al*; US 6226549 B1; Method for classifying a time series, that includes a prescribable plurality of samples, with a computer
- *Deco et al*; US 6134510 A; Method for detecting synchronicity between several digital measurement series with the aid of a computer
- *Shibata et al*; US 6456992 B1; Semiconductor arithmetic circuit
- *DECO et al*; WO 9819252 A1; METHOD OF CLASSIFYING STATISTICAL DEPENDENCY OF A MEASURABLE SERIES OF STATISTICAL VALUES
- *DECO et al*; WO 9750047 A1; PROCESS FOR CLASSIFYING A TIME SERIES HAVING A PREDETERMINABLE NUMBER OF SCANNING VALUES, E.G. AN ELECTRIC SIGNAL, BY MEANS OF A COMPUTER
- *DECO et al*; WO 9735267 A1; METHOD OF CLASSIFYING A TIME SEQUENCE HAVING A PREDETERMINED NUMBER OF SAMPLING VALUES, FOR EXAMPLE AN ELECTRICAL SIGNAL, BY A COMPUTER
- *DECO et al*; WO 9733238 A1; PROCESS FOR CLASSIFICATION OF A TIME SERIES WHICH CONTAINS A PRE-SET NUMBER OF SAMPLE VALUES, PARTICULARLY OF AN ELECTRICAL SIGNAL, BY MEANS OF A COMPUTER

- *Lin et al*; Classification of QRS pattern by an associative memory model; Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society; vol.6; 9-12 Nov. 1989; pp 2017-2018

- *Kuczewski et al*; Helicopter fault detection and classification with neural networks; International Joint Conference on Neural Networks; Vol 2; 7-11 June 1992; pp 947-956

- *Haikonen*; Towards associative non-algorithmic neural networks; IEEE International Conference on Neural Networks; Vol. 2; 27 June-2 July 1994; pp 746-750

- *Tomlinson et al*; A digital neural network architecture for VLSI; International Joint Conference on Neural Networks; vol.2; 17-21 June 1990; pp 545-550

- *Klaassen et al*; Learning pulse coded spatio-temporal neurons with a local learning rule; International Joint Conference on Neural Networks; Vol. i; 8-14 July 1991; pp 829-836

- *Tam*; Decoding of firing intervals in a temporal-coded spike train using a topographically mapped neural network; International Joint Conference on Neural Networks; vol.3; 17-21 June 1990; pp 627-632

- *Deco et al*; Training data selection by detecting predictability in non-stationary time series by a surrogate-cumulant based approach; International Workshop on Neural Networks for Identification, Control, Robotics, and Signal/Image Processing Proceedings; 21-23 Aug. 1996; pp 11-19

- *Sterzing et al*; Recurrent neural networks for temporal learning of time series; IEEE International Conference on Neural Networks; vol.2; 28 March-1 April 1993; pp 843-850

- *Obradovic et al*; Blind source separation: are information maximization and redundancy minimization different?; IEEE Workshop Proceedings Neural Networks for Signal Processing VII; 24-26 Sept. 1997; pp 416-425
- *Maass et al*; Pulsed Neural Networks; 30 Nov. 1998; pp xiii-xxiii, xxv-xxix

Any inquiry concerning this communication or earlier communications from the Office should be directed to Meltin Bell whose telephone number is 571-272-3680. This Examiner can normally be reached on Mon - Fri 7:30 am - 4:00 pm.

If attempts to reach this Examiner by telephone are unsuccessful, his supervisor, Anthony Knight, can be reached on 571-272-3687. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MB / M.B. /
July 1, 2005

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